

# EVIDENCE BASED PUBLIC HEALTH POLICY AND PRACTICE

## The population effect of crime and neighbourhood on physical activity: an analysis of 15 461 adults

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Area-based interventions offer the potential to increase physical activity for many sedentary people in countries such as the UK. Evidence on the effect of individual and area/neighbourhood influences on physical activity is in its infancy, and despite its value to policy makers a population focus is rarely used. Data from a population-based health and lifestyle survey of adults in northwest England were used to analyse associations between individual and neighbourhood perceptions and physical activity. The population effect of eliminating a risk factor was expressed as a likely effect on population levels of physical activity. Of the 15 461 responders, 21 923 (27.1%) were physically active. Neighbourhood perceptions of leisure facilities were associated with physical activity, but no association was found for sense of belonging, public transport or shopping facilities. People who felt safe in their neighbourhood were more likely to be physically active, but no associations were found for vandalism, assaults, muggings or experience of crime. The number of physically active people would increase by 3290 if feelings of “unsafe” during the day were removed, and by 11 237 if feelings of “unsafe” during the night were removed. An additional 8342 people would be physically active if everyone believed that they were “very well placed for leisure facilities”. Feeling safe had the potential largest effect on population levels of physical activity. Strategies to increase physical activity in the population need to consider the wider determinants of health-related behaviour, including fear of crime and safety.

“who you are” and “where you live”,<sup>9</sup> although challenging,<sup>6</sup> is essential to inform the development of interventions to seriously reduce the number of people living mainly sedentary lives.

In the general population, regular physical activity is more likely among men, younger adults, people with other healthy lifestyle behaviours (eg, non-smoking, greater intake of fruit and vegetables), those reporting good general health and no history of chronic disease.<sup>2</sup> The aim of the current study was to examine neighbourhood influences on physical activity and to quantify this in terms of the population effect using population impact measures (PIMs).<sup>10</sup> PIMs provide a population perspective by adding incidence information to traditional measures of risk, such as the population attrib

risk, thus, providing information on the actual numbers of people who are at risk from specific exposures in a particular population to assist local policy decisions.<sup>11</sup>

### METHODS

The study was based in two districts in northwest England, which is divided into 44 administrative electoral wards. Data from the 2001 national census calculated a resident population of 567 600 adults: 94% were white people and the population density was 1700 people per square kilometre.<sup>12</sup> Methods for data collection have been described previously.<sup>2 13 14</sup> In brief, data were collected using a postal self-completion questionnaire as part of a population-based health and lifestyle survey in 2001. The sampling frame was all resident adults on the general practitioner register and systematic sampling was used to select a 5% sample. The postal questionnaire was sent with a covering letter and a business pre-paid return envelope. Non-responders were sent a reminder postcard 10 days later. After another 10 days, persistent non-responders were sent a reminder letter with another copy of the survey and a return envelope. The questionnaire included an introduction in Gujarati and Urdu, the main second languages spoken in the area, with information on the local health translation services. A favourable opinion was received from the local research ethics committees before starting the study.

The 50-item questionnaire sought information on general and specific health, health behaviours and perceptions of neighbourhood. Question constructs were taken from previous national

In the UK, as many as two thirds of adults live sedentary lives,<sup>1 2</sup> representing one of the least physically active nations of 15 European member states.<sup>3</sup> Lack of regular physical activity is associated with marked preventable mortality and morbidity<sup>4</sup> and is a public health priority. Although efforts to increase physical activity among individuals have had some small effect,<sup>5–7</sup> modifying social, economic and environmental factors may be more successful at the population level.<sup>6</sup> Indeed, evidence is emerging that contextual or area-level factors, including transport systems, land use mix, population density and leisure opportunities, are related to population levels of physical activity.<sup>7–10</sup> However, few studies have examined this in the UK<sup>8</sup> despite sedentary behaviour being a major public health concern. Increasing our understanding of the relationship between physical activity,

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**Abbreviation:** PIM, population impact measure

surveys.<sup>1-14</sup> The questions specific to the neighbourhood asked respondents about the following: the extent that they felt they belonged to that area (strongly agree to strongly disagree); how well placed their home was for public transport, general shopping and leisure facilities (very well placed to badly placed); in their neighbourhood how much of a problem was vandalism; assaults and muggings; speeding traffic; and whether they had been the subject of personal crime in the past year. They were also asked whether they felt safe "out and about" in their neighbourhood during the day and during the night. Multiple deprivation was measured using the Townsend Index, which is constructed on four census variables (unemployment, overcrowding, non-car ownership and non-home ownership).<sup>15</sup> Townsend Scores from 1142 census enumeration districts for the two electoral districts in the study were assigned using the participants' postal code.<sup>16</sup>

Physical activity was assessed using the Godin and Shephard instrument.<sup>17</sup> This is valid for use in epidemiological studies and discriminates between adults participating in different amounts and types of physical activity. Participants were asked to record how many times in the past week they had engaged in light, moderate or vigorous activity for a session lasting at least 15 min. Examples of moderate physical activity included brisk walking, table tennis, easy cycling, golf, dancing and cleaning windows; vigorous activity included running, football, cardiovascular gym workouts and aerobics. In the current analysis, physically active was defined as participating in at least five sessions per week of moderate or vigorous physical activity, with each session lasting at least 15 min.<sup>17</sup>

## Analysis

Individual associations with physical activity and neighbourhood factors were expressed as relative differences (prevalence rate ratios) using a modified Poisson regression approach.<sup>18</sup> This involves fitting a generalised linear model to the data with a log link and a Poisson error term. The outcome variable in these models was being physically active, and the predictor variables were the health and lifestyle behaviours. The robust variance estimator was used to adjust for misspecification of the error term. The analyses controlled for the potential confounding effects of age, sex, ethnicity and deprivation. Data were analysed Stata V.8.2 (StataCorp, College Station, Texas, USA).

The population effect of eliminating a risk factor was calculated when the relative risk was statistically significant. The calculation excluded a time element, given the cross-sectional nature of our data. Its formula is<sup>10</sup>:

$$\text{PIN-ER} = n \times I_p \times \text{PAR}$$

where  $n$  is the population size;  $I_p$  is the incidence of sedentary behaviour (physical inactivity) in the whole population; PAR is the population attributable risk ( $P_e(RR-1)/(1+P_e(RR-1))$ );  $P_e$  is proportion of the population who is physically inactive; RR is relative risk.

Calculations of the population attributable risk for variables with multiple strata were adjusted according to the methods of Hanley.<sup>19</sup>

## RESULTS

In June 2001, 70.1% of the sample returned a useable questionnaire (15 461/21 923). Their mean age was 49.8 (standard deviation (SD) 17.6) years, 45.2% (6986) were men and 95.5% (14 765) described themselves as Caucasians. The mean age of responders was 8.3 years more than that of non-responders. No other information on non-responders was available for comparisons. In all, 27.1% (4193/15 461) of responders defined themselves as being physically active. The mean age of physically active respondents was 10 years lesser than those not defined as being physically active (42.5 v 52.5 years,  $p = 0.001$ ).

We found no differences in the proportion of men and women who were defined as physically active (27.6% v 26.7%), but those described as Caucasians compared with non-Caucasians had a higher relative prevalence of physical activity (1.32, 95% confidence interval (CI) 1.16 to 1.52). For deprivation, a graded relationship was observed, with the prevalence of physical activity reducing across each of the deprivation quintiles (table 1).

Looking at neighbourhood factors, a graded relationship was observed between how well people thought their neighbourhood was for leisure facilities and the prevalence of being physically active (table 2).

We found no association between physical activity and sense of "belonging" to their neighbourhood, how well placed they believed their neighbourhood was for public transport and for general shopping (table 2).

**Table 1** Prevalence of physical activity by baseline characteristics

	Number of respondents*	Physically active, % (n)	Unadjusted relative prevalence (95% CI)	Adjusted relative prevalence (95% CI)†
Everyone	15 461	27.1 (4193)	—	—
Sex				
Male	6 984	27.6 (1927)	1.00	1.00
Female	8 477	26.7 (2266)	0.97 (0.92 to 1.02)	0.97 (0.92 to 1.01)
Ethnicity				
Non-white	689	75.9 (523)	1.00	1.00
White	14 559	27.5 (4004)	1.14 (1.00 to 1.30)	1.32 (1.16 to 1.52)
Deprivation quintiles‡				
1 (least deprived)	3 512	30.4 (1066)	1.00	1.00
2	3 037	28.1 (853)	0.93 (0.86 to 1.0)	0.92 (0.85 to 0.99)
3	2 726	27.8 (759)	0.92 (0.85 to 0.99)	0.90 (0.84 to 0.97)
4	2 812	26.1 (734)	0.86 (0.79 to 0.93)	0.85 (0.78 to 0.91)
5 (most deprived)	3 279	22.9 (752)	0.76 (0.70 to 0.82)	0.77 (0.72 to 0.84)

\*Not all respondents answered every question.

†Adjusted for all variables in the table.

‡Townsend Score at enumeration level as a proxy for individual deprivation.

**Table 2** Association of physical activity with individual perceptions of neighbourhood facilities

Variable	Number of respondents*	Physically active, % (n)	Unadjusted relative prevalence (95% CI)	Adjusted relative prevalence (95% CI)†
How well placed for leisure facilities?				
Very well	2926	30.3 (886)	1.00	1.00
Fairly well	3792	29.4 (1115)	0.97 (0.90 to 1.05)	0.95 (0.88 to 1.02)
Average	4212	28.6 (1203)	0.94 (0.88 to 1.01)	0.96 (0.89 to 1.03)
Not very well	2192	26.3 (576)	0.87 (0.79 to 0.95)	0.90 (0.82 to 0.98)
Badly	1493	23.0 (344)	0.76 (0.68 to 0.85)	0.86 (0.77 to 0.94)
Feel of belonging to the area?				
Strongly agree	3300	26.2 (864)	1.00	1.00
Agree	5928	26.9 (1594)	1.03 (0.96 to 1.10)	0.98 (0.92 to 1.05)
Neither agree nor disagree	4069	30.3 (1232)	1.16 (1.07 to 1.25)	0.99 (0.92 to 1.06)
Disagree	1042	28.7 (299)	1.10 (0.98 to 1.23)	0.93 (0.84 to 1.04)
Strongly disagree	451	29.1 (131)	1.11 (0.95 to 1.30)	0.90 (0.77 to 1.04)
How well placed for transport?				
Very well	6728	27.9 (1878)	1.00	1.00
Fairly well	4380	28.4 (1244)	1.02 (0.96 to 1.08)	0.98 (0.92 to 1.04)
Average	2668	26.9 (718)	0.96 (0.90 to 1.04)	0.95 (0.88 to 1.01)
Not very well	780	28.1 (219)	1.01 (0.89 to 1.13)	1.01 (0.90 to 1.13)
Badly	335	24.2 (81)	0.87 (0.71 to 1.05)	0.89 (0.73 to 1.08)
How well placed for general shopping?				
Very well	5059	28.1 (1423)	1.00	1.00
Fairly well	4626	29.1 (1344)	1.03 (0.97 to 1.10)	1.00 (0.94 to 1.06)
Average	3633	27.3 (991)	0.97 (0.90 to 1.04)	0.95 (0.90 to 1.01)
Not very well	1183	23.9 (283)	0.85 (0.76 to 0.95)	0.93 (0.83 to 1.03)
Badly	504	24.2 (122)	0.86 (0.73 to 1.01)	1.00 (0.86 to 1.17)

\*Not all respondents answered every question.

†Adjusted for age, sex, ethnicity and deprivation (Townsend Score at enumeration district).

People who felt unsafe out and about in their neighbourhood during the day (relative prevalence 0.70, 95% CI 0.59 to 0.82) and during the night (relative prevalence 0.82, 95% CI 0.78 to 0.88) were significantly less likely to be defined as physically active compared with those who felt safe during these times (table 3).

We observed no association for physical activity and people stating that vandalism, and assaults or muggings were a problem in their neighbourhood, also not among people who had or not been victims of personal crime during the past year. People who thought that there was some problem with speeding traffic in their neighbourhood were more likely to

**Table 3** Association of individual perceptions of crime and safety with physical activity

	Number of respondents*	Physically active, % (n)	Unadjusted relative prevalence (95% CI)	Adjusted relative prevalence (95% CI)†
Feel safe out in neighbourhood				
During the day?				
Yes	14 155	28.3 (4009)	1.00	1.00
No	758	15.8 (120)	0.55 (0.47 to 0.66)	0.70 (0.59 to 0.82)
During the night?				
Yes	9 601	31.1 (2982)	1.00	1.00
No	5 305	21.6 (1148)	0.70 (0.66 to 0.74)	0.82 (0.78 to 0.88)
How much of a problem to you are any of the following				
Vandalism?				
Not a problem	5 424	28.0 (1518)	1.00	1.00
Some problem	7 799	28.5 (2221)	1.01 (0.96 to 1.08)	1.05 (1.00 to 1.11)
Serious problem	1 525	25.6 (391)	0.92 (0.83 to 1.01)	1.01 (0.92 to 1.12)
Assaults or muggings?				
Not a problem	10 161	28.8 (2921)	1.00	1.00
Some problem	3 817	28.3 (1079)	0.98 (0.93 to 1.04)	1.01 (0.95 to 1.07)
Serious problem	372	25.3 (94)	0.88 (0.74 to 1.05)	0.91 (0.77 to 1.08)
Speeding traffic?				
Not a problem	5 491	26.8 (1474)	1.00	1.00
Some problem	6 255	29.4 (18.7)	1.09 (1.03 to 1.16)	1.08 (1.10 to 1.14)
Serious problem	2 925	28.2 (824)	1.05 (0.98 to 1.13)	1.04 (0.97 to 1.11)
Personal experience of crime in the past year?				
Yes	2 649	29.6 (786)	1.09 (1.02 to 1.17)	0.97 (0.91 to 1.03)
No	12 404	27.2 (3370)	1.00	1.00

\*Not all respondents answered every question.

†Adjusted for age, sex, ethnicity and deprivation (Townsend Score at enumeration district).

**Table 4** Estimated population effect on physical activity from changing neighbourhood perceptions

	Number	Number of respondents answering this question	RR of being sedentary	P <sub>e</sub>	PAR	Number of adults in this population	Proportion physically active overall	PIN-ER*
Feel unsafe								
During the day	758	14 913	1.43	0.05	0.021	567 600	0.27	3 290
During the night	5 305	14 606	1.23	0.34	0.073	567 600	0.27	11 237
How well placed for leisure facilities								
Very well	2 926	14 615	Ref	Ref	Ref			
Fairly well	3 792	14 615	1.05	0.26	0.01			
Average	4 212	14 615	1.04	0.29	0.01			
Not very well	2 192	14 615	1.11	0.15	0.02			
Badly	1 493	14 615	1.16	0.10	0.02			
Overall PAR					0.05	567 600	0.27	8 342

PAR, population attributable risk; P<sub>e</sub>, proportion of the population who is physically inactive; PIN-ER, population effect of eliminating a risk factor.

\*The number of people expected to become physically active if everyone in this population felt safe during the day, or felt safe during the night, or thought their neighbourhood was very well placed for leisure facilities, calculated as  $PIN-ER = n \times I_p \times PAR$ , where  $n$  is the population size;  $I_p$ , the incidence of sedentary behaviour (physical inactivity) in the whole population;  $PAR = (P_e(RR - 1) / 1 + P_e(RR - 1))$ .

be physically active, but this was not consistent to this being a serious problem.

Table 4 shows the population effect of eliminating statistically significant risk factors for sedentary behaviour.

The data suggest that the number of physically active people would increase by 3290 if feelings of being unsafe during the day were removed, and by 11 237 if feelings of being unsafe during the night were removed. An additional 8342 people would be physically active if everyone believed that they were "very well placed for leisure facilities". In absolute terms, this would be expected to increase the current level of physical activity in the population by 0.6%, 2.0% and 1.5%, respectively (table 5).

## DISCUSSION

Our work represents one of the most comprehensive assessments of individual and contextual associations with physical activity among adults in the UK general population. We have previously confirmed low levels of physical activity among several adults, which decreased with advancing age and by socioeconomic deprivation.<sup>2</sup> The focus of the current investigation was to examine the association of physical activity with contextual factors, based on the notion that both individual and contextual factors can influence physical activity. We found that individual perceptions of how well placed their

neighbourhood was for leisure facilities were considerably associated with physical activity. The fact that this increased across each response category adds strength to this dose-response association. We also found that feeling safe in the neighbourhood during the day or during the night was positively associated with physical activity. Our approach of applying population effect measures suggested that the greatest increase in physical activity would be achieved in the population if everyone was made to feel safe during the night, with only a small effect if everyone was made to feel that their neighbourhood was well placed for leisure facilities. Therefore, if we are to increase population levels of physical activity, increasing feelings of safety seems to be a greater priority than improving perceptions regarding the provision of leisure facilities.

In our study, we failed to find any consistent association between physical activity and sense of belonging to the neighbourhood or perceptions about transport or shopping facilities, or problems in the neighbourhood from unsociable and criminal behaviours. Perhaps these did not differ sufficiently across the study setting to influence physical activity or among this population these factors may have had little effect on this behaviour.

The strengths of our study are its population focus, a large sample size with good response rates and data on a wide range

**Table 5** Number of people in the total population expected to become physically active if neighbourhood perceptions improved

	Number of adults in this population	Currently physically active (%)*	Currently physically active (n)†	PIN-ER‡	Expected to be physically active (n)§	Expected to be physically active (%)¶	Absolute increase in people expected to be physically active (%)**
Feel safe							
During the day	567 600	27.0	153 252	3 290	156 542	27.6	0.6
During the night	567 600	27.0	153 252	11 237	164 489	29.0	2.0
How well placed for leisure facilities							
Very well	567 600	27.0	153 252	8 342	161 594	28.5	1.5

PIN-ER, population effect of eliminating a risk factor.

\*Observed in the survey.

†Calculated as number of adults in the population  $\times$  (percentage of adults physically active/100).

‡From table 4.

§Number of adults physically active + PIN-ER.

¶Expected number in the population to be physically active as a proportion of total population.

\*\*Difference between expected percentage of the population to be physically active and percentage of the population currently physically active.



of possible effects on physical activity. The survey included validated questions and reflected those used in national surveys and surveillance systems. We also adjusted for the potential confounding effects of area deprivation, using the participants' postcode linked to deprivation data at an enumeration level. Although this method has been found to be an effective method to examine the effect of individual deprivation on health,<sup>16</sup> some misclassification may have taken place.

PIMs are a recently described addition to other measures of population effect, such as population attributable risk.<sup>10</sup> PIMs add information on incidence to estimate the number of people in a total population who may benefit (or be at risk) from an intervention. As such, they provide a population perspective to inform local policy decisions.<sup>16–20</sup> In the current study, this method has been used to estimate the effect of neighbourhood and neighbourhood perceptions on sedentary behaviour in adults.

Our study relied on self-reported measures, which may be subject to measurement error, and our control for confounders was limited to the data originally collected. Simple methods for assessing physical activity have been found to reliably predict outcomes such as mortality,<sup>21</sup> supporting their wide application in epidemiological studies. Response bias is a known problem in population studies and just <30% of those in the original sample did not return a useable questionnaire. A previous study found that non-responders were less likely to be physically active compared with responders.<sup>22</sup> Therefore, the true prevalence of sedentary behaviour in the population studied might be more than what we observed.

The main weakness of our cross-sectional study is that a cause–effect relationship between the factors we examined and their effect on physical activity cannot be assumed. We have been careful to use the term “association” rather than “relationship”. Therefore, our calculation of the population effect of eliminating a risk factor, which assumes a cause–effect relationship, needs to be interpreted with caution. We make no claim here that making people feel safe in their neighbourhood would, in itself, increase the number of people who would be physically active. Rather, we have applied PIMs to highlight the potential effect of changes in particular neighbourhood factors on physical activity, and state that intervention studies are the only sure way to examine their effect. However, in practice, given the paucity of community-based evaluations, policy makers often rely on cause–effect relationships to be assumed to some degree. We have merely applied a population perspective to such interpretation.

Few studies have previously examined the influence of feelings of safety on physical activity, particularly in the UK. A small cross-sectional study in England<sup>23</sup> found that women were more likely to walk at least 15 min a week if they felt safe during the day. In the US, perceptions of safety for walking were associated with actual walking,<sup>24</sup> and crime was perceived as more of a problem in socially deprived areas that also had low levels of physical activity.<sup>25</sup> Similarly, Americans who perceived their neighbourhood as less than extremely safe were more than twice as likely to have no leisuretime physical activity, and those who considered it to be not at all safe were nearly three times as likely to have no leisuretime physical activity.<sup>26</sup> However, in a Danish study, although participating in sports activities was inversely related to perceptions about the amount of police attention their neighbourhood received,<sup>27</sup> it was not found to influence walking and cycling activities.

Evidence on the possible role of perceptions relating to the location of leisure facilities and physical activity is conflicting. Our own findings support an independent association of perceived access to recreational facilities and physical activity, although its population effect was much less than for feelings

## What this paper adds

- Few studies have considered the wider determinants of health on levels of physical activity in the population.
- Feeling safe in the home and out and about in the neighbourhood may have as large an effect on population levels of physical activity as factors such as access to leisure facilities.

## Policy implications

- Making people feel safer in their neighbourhood is a key priority to increase population levels of physical activity.

of safety. This differs to the earlier study in England,<sup>23</sup> but supports findings in Australia<sup>28</sup> and the US.<sup>29–30</sup> Consequently, we argue the urgent need to carry out prospective studies in the UK, which, wherever possible, will make full use of the many “natural experiments” around the country to obtain reliable evidence on the effect of contextual changes on population levels of physical activity.

## CONCLUSION

Our study suggests that feeling unsafe in the neighbourhood is as much of a barrier to physical activity as how well people thought their home was for access to leisure facilities. As such, strategies to increase physical activity need to emphasise the perceived effect of feeling safe among the local population. Encouraging people to spend more time walking for leisure and commuting purposes seems to be a sensible approach to incorporate physical activity within activities of daily living. For this to become a reality, we need to start by ensuring that people feel safe out and about in their neighbourhood.

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## SPEAKER'S CORNER.....

### Patient centredness

**P**atient centredness is one of the current buzz phrases in the British National Health Service. At its best, the term expresses a great aspiration, a wish for health professionals to engage with patients as equal partners at a deep level that includes understanding both their illness and what it will mean for patients in their life context.<sup>1</sup> However, there are difficulties with the concept, both at the level of its definition and in its implementation.<sup>2,3</sup>

At its worst, it is simply a buzz phrase, which sounds good and allows managers and politicians to seem to be on the patient's side. In the wider economic sphere, Zuboff and Maxmin<sup>4</sup> draw attention to the fact that many organisations that claim to be "customer focused" actually are not. Perhaps patient centredness is the health sector's equivalent term.

It is not always clear at what level patient centredness should apply. Is it at the level of individual doctors and patients? Is it at the level of the whole system? The idea that a healthcare system that has to provide care to millions of patients can be focused on one individual patient is clearly impossible.

It is far from clear that the health service should be entirely patient centred. The health service must exist to meet the needs of patients (if it does not do this, it has no function). The health service cannot conceivably meet the needs of patients solely by focusing on them.

Indeed, a one-sided approach focused solely on patients risks alienating health professionals by playing down the importance of their professional knowledge and skill. The knowledge of

medicine, and related professions, is entirely patient centred in that it is all ultimately derived from the study of patients. It has only one purpose, which is to help patients, and it is only brought to fruition when this goal is achieved.

The argument should not be about patient or professional centredness. The key unit of medicine is the professional–patient dyad, the interaction in which hopefully the professional and the patient come to a useful shared understanding of the patient's illness or predicament.<sup>5</sup>

A truly patient-centred National Health Service would support both sides of the professional–patient dyad appropriately, and would not look to champion one against the other. It would be a shame if the ideal of patient centredness was lost to one-sided interpretations of the term.

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